User Manual:
TT8540PB001MAN

Skypatrol Evolution
GSM/GPRS Mobile Location Unit
Users' Manual

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- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

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Revision History

Skypatrol Evolution GSM/GPRS MLU
User Manual
TT8540PB001MAN

Date	Rev	Author	Description
AUGUST 31, 2005	**1.00A**	L. Quiñones	Initial Release
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1 Introduction

1.2 About the GSM/GPRS EVOLUTION

The GSM/GPRS EVOLUTION (hereafter referred to as "EVOLUTION") is an Automated Vehicle Locating (AVL) device that utilizes a GSM/GPRS modem and a Global Positioning Satellite (GPS) module. Working together, these technologies allow the EVOLUTION to simultaneously act as a stand alone GPS reporting device and wireless data retrieval unit. The EVOLUTION provides a flexible AVL solution with Input/Output (I/O), six selectable National Maritime Electronics Association (NMEA) GPS data format, Trimble ASCII Interface Protocol (TAIP) GPS data format, and Skypatrol's own proprietary Binary GPS data format. The EVOLUTION is designed to work in a stand-alone device in an automobile. Skypatrol's EVOLUTION provides maximum AVL versatility in a single affordable device.

1.3 About This Manual

Contained in this manual are instructions on how to install and configure the EVOLUTION. Please follow the instructions herein closely to avoid damaging the EVOLUTION.

1.4 Contents of Basic Package

- Skypatrol EVOLUTION (P/N - TT8540)
- Configuration tool – download from www.skypatrol.net

1.5 Available Accessories

The following accessories for the EVOLUTION are available directly from Skypatrol:

- GPS antenna magnetic mount (P/N ANT014).
- Communications antenna glass mount (P/N ANT027).
- 12-pin serial I/O loading cable with DB-9 connector (P/N CBL030).
- 12-pin connector (P/N CBL028).
- 3 wire power harness for use with connector (P/N CBL027).
- Mounting plate (P/N MSC050)

1.6 System Requirements

It's necessary to have some type of terminal equipment, which includes a serial port, in order to configure the EVOLUTION modem. This can be a computer running a Windows Operating System with the HyperTerminal program.

1.7 EVOLUTION Front and Back View

Figure 1 - Skypatrol EVOLUTION Front View

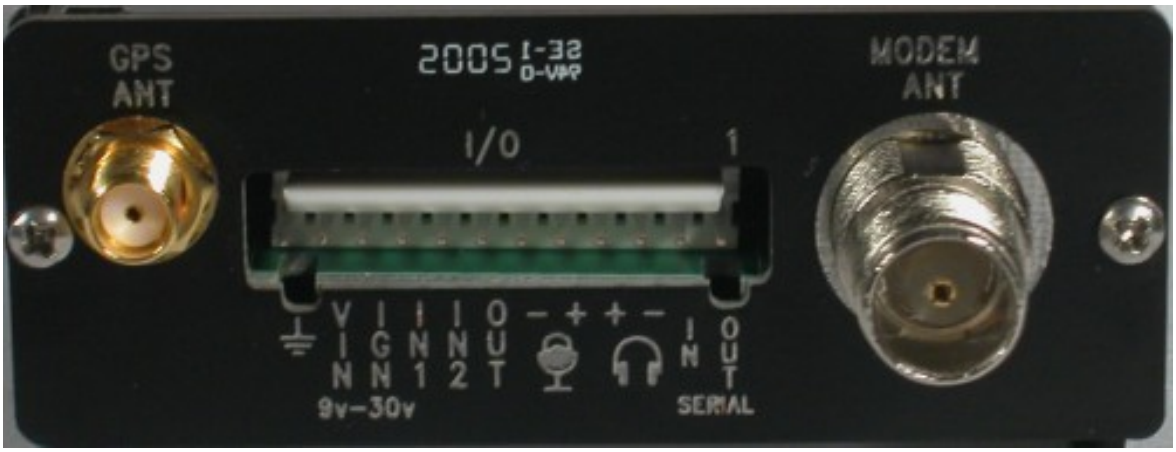

Figure 2 - Skypatrol EVOLUTION Back View

1.8 Product Specifications

System Requirements

Interface:	Serial Host DSUB 9 connector
L x W x H:	4.0 x 5.0 x 1.6 in
Housing:	One Piece, seamless Aluminum Extrusion
TX Power:	Class 4 (2W @850/900 MHz) Class 1 (1W @1800/1900 MHz)
Slot Class:	MS10(4RX/2TX, 5 MAX)

Application Interface

- Host Protocols: PPP, AT Commands, UDP, TCP/IP
- Internal Protocols: UDP, TCP/IP (future release)
- API Control/Status: AT or UDP
- Friend s'IP Feature
- Auto-Registration software upon power-up
- Over the air commands for:
  - I/O Control
  - GPS TX Interval
  - Binary Reporting
  - Timed Reporting
  - Alarm Reporting
  - Status Change Reporting
  - GPS Content
  - Event Reporting
  - Distance Reporting
  - Geo-Fencing

Band Operation

TT8540 (850/900/1800/1900)

SIM CARD / INTERFACE / I/O

- SMA Antenna Connector for 3.3 Vdc GPS 3.3
- External SIM accessible via end cap
- Audio connection
- TNC Antenna Connector for GSM
- 3 Pin I/O 2 Input, 1 Output
  3 LED Status indicators
  1 Ignition Sense
- 1 Audio Input/Output

GPRS Packet Data

Mode:	Class B, Multislot 10 Certified
Protocol:	GPRS Release 97, SMG 31
Coding Schemes:	CS1 CS4
Packet Channel:	PBCCH/PCCCH

Environment

Operating:	-30°C to +70°C
Spec. Compliant:	-20°C to +60°C
Storage:	-40°C to +85°C
Humidity:	Up to 95% non-condensing

GSM Functionality

Voice:	Full Rate, Enhanced full rate and half rate, AMR (TT8540)
CS Data:	Asynchronous, transparent and non transparent up to 9.6 KB
GSM SMS:	Text, PDU, MO/MT Cell broadcast

Status Indicator

POWER ON

- Registration Status
- GPS Status
- User Defined

Certification (Pending)

TT8540

FCC: Part 15,22,&24	Part 15
GCF: Version 3.11.0	Version 3.5.1
PTCRB: Version 2.9.1	Version 2.7.2
Industry Canada	Industry Canada
RTTE	RTTE

Power

DC Voltage: 9 30 V

TT8540 BAND	**@ 12V MODE**	**Avg (mA)**	**Peak (A) @ (dBM)**
GSM 850& 900	1TX/1RX	390	0.600 @ 32.5
	1RX	180	
	Idle	65	
GSM 1800& 1900	1TX/1RX	400	0.570 @ 32.0
	1RX	190	
	Idle	55	

GPS Functionality

- SMA Antenna Connector for GPS
- Supports 3.3V Active Antenna
- GPS Protocols: NMEA, TAIP, Skypatrol binary
- Stored GPS Messages Feature

Part Number

TT8540 850/900/1800/1900

2 Installation

Instructions provided in this section describe the hardware installation of the EVOLUTION device. To install the EVOLUTION in a vehicle, follow these steps:

- Choose a convenient location in the vehicle – either in the trunk or interior of a vehicle. Avoid locations that might expose the device to excessive heat or moisture.
- Hold the EVOLUTION in place and mark the location for mounting screw holes
- Using the markings as a guide, drill mounting holes in those positions
- Align the EVOLUTION in the drilled holes and secure it with mounting screws

The EVOLUTION is **NOT** a waterproof or sealed device. Care must be taken to ensure the device is kept away from water or any other liquids.

2.1 Mounting Dimensions

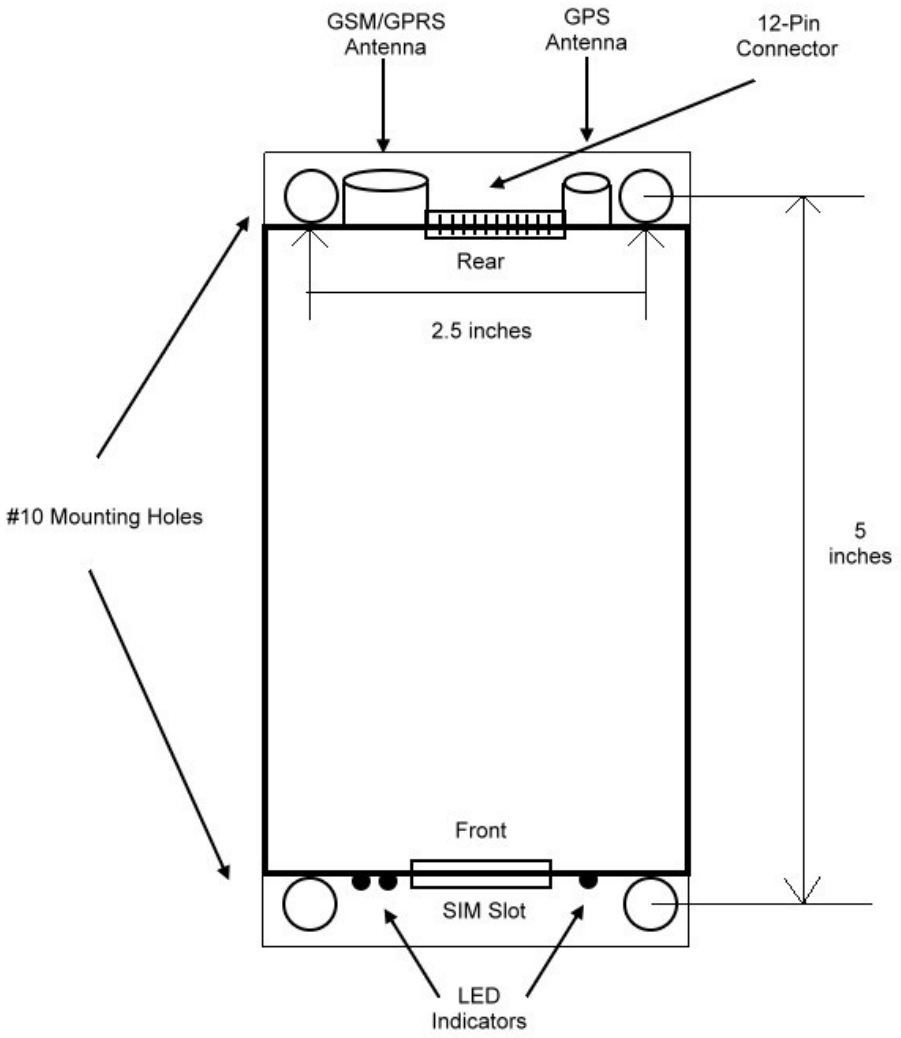

Figure 3 - Mounting dimensions of the EVOLUTION (Shown with mounting plate)

The bracket should be used as a template to mark screw holes for installation. See Figure 4 - EVOLUTION Mounting Brackets. The mounting holes are designed for a number 10 screw. Once mounting holes have been located for placement, the mounting plate can be easily broken into two parts as demonstrated in Figure 5 - EVOLUTION Mounting Bracket (separated). The mounting bracket must be separated in order to affix it to the EVOLUTION. The two pieces will easily slide into the grooves on the modem.

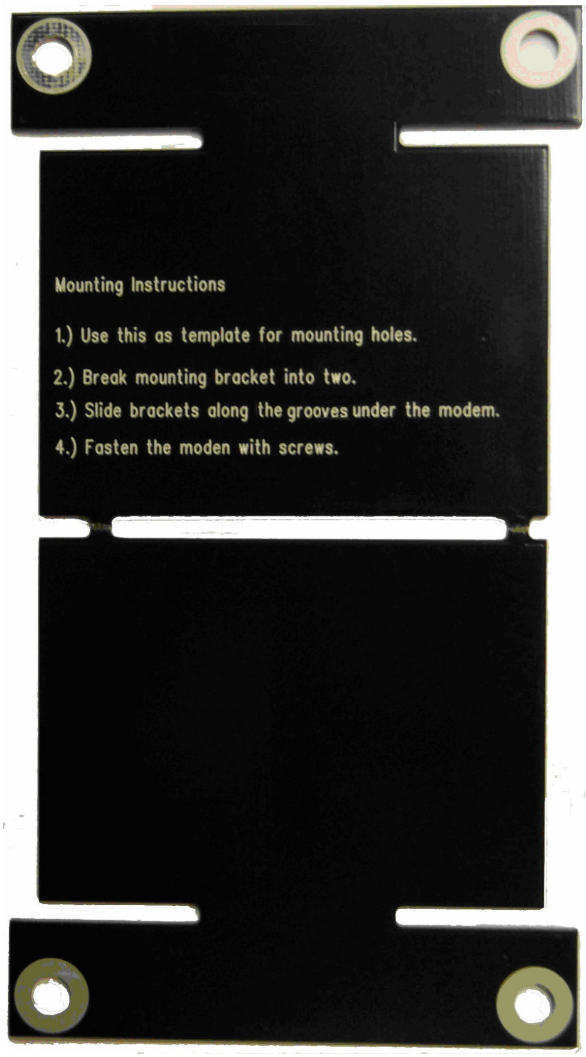

Figure 4 - EVOLUTION Mounting Bracket (attached)

Figure 5 - EVOLUTION Mounting Bracket (separated)

Figure 6 - EVOLUTION Bracket Installation

Figure 7 - EVOLUTION Bracket Installation

2.2 Installing Cables

During installation, the following precautions will help ensure proper operation of the EVOLUTION

- Remove power from the EVOLUTION.
- Do not create loops, sharp bends or crimps in the cables
- All cables should be attached to the vehicle and equipment in such a way to reduce stress or wear caused by vibration generated by moving vehicles.
- Use proper terminations on all power cables

2.2.1 12 pin Connector

The user can purchase the optional 12-pin external I/O connector for the Skypatrol EVOLUTION that can be used to interface with other devices. Skypatrol can provide an optional cable (P/N CBL027) and connector (P/N CBL028). The user also has the option of building his/her own cable. Table 1 describes the pin functionality for this 12 pin I/O connector. Pins that are not planned for usage can be left open without anything connected to them.

Pin Number	Functionality
Pin – 1	Serial Data Out
Pin – 2	Serial Data In
Pin – 3	Audio – Ear Speaker Out (-)
Pin – 4	Audio – Ear Speaker Out (+)
Pin – 5	Audio – Mic Input (+)
Pin – 6	Audio – Mic Input (-)
Pin – 7	User Controlled Output
Pin – 8	User Controlled I/O
Pin – 9	User Controlled I/O
Pin – 10	Switched Power (Ignition)
Pin – 11	Unswitched Power (Battery)
Pin – 12	Ground

Table 1 - 12 pin I/O Connector Interface

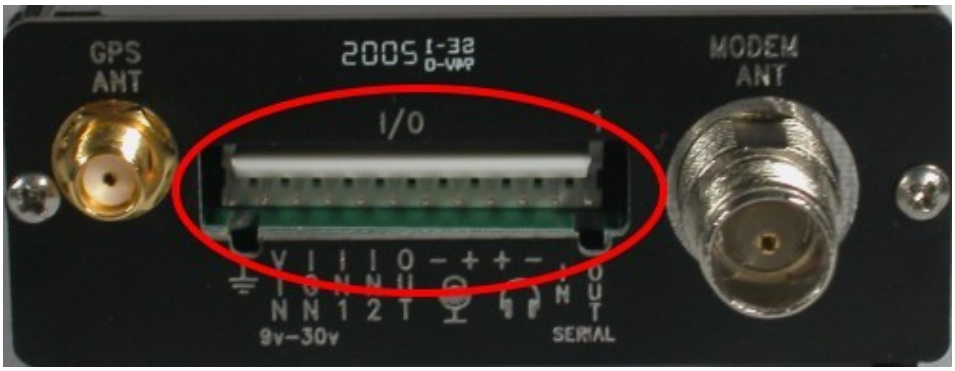

Figure 8 - I/O Connector

2.2.2 3 – Pin RS232 Serial Connector

The EVOLUTION provides a 3-pin RS232 serial connector to interface with a computing device. The 3-pin Serial Connector consists of ground, in and out pins. See Figure 9 - 12-Pin Connection.

Figure 9 - 12-Pin Connection

2.3 Installing Subscriber Identity Module (SIM) Card

The SIM, an integral part of any GSM terminal device, is a “smart card” that is programmed with subscriber information. The user information consists of an International Mobile Subscriber Identity (IMSI) number which is registered with the GSM/GPRS service provider and an encryption Ki (pronounced “key”). This information consists of a microprocessor and memory installed on a plastic card. A SIM card can be installed by simply inserting the SIM card in the SIM slot provided in the front of the device. See Figure 10 - Inserting a SIM below.

Note: The SIM card is not provided with the EVOLUTION device. The SIM must be obtained from the GSM/GPRS service provider and must be provisioned by the operator for data and/or voice. Always take care to protect the SIM. EVOLUTION’s GSM/GPRS related functionality will not operate without the SIM installed.

Ensure the power to the EVOLUTION is disconnected before inserting the SIM card. Failure to do so might result in unusable EVOLUTION or a damaged SIM card.

Skypatrol is not liable for damages to the EVOLUTION when inserting a SIM card inside the device. (TT8540 only).

Insert the SIM into the SIM Slot with the notch going into the slot first, and facing toward the left side of the modem.

Figure 10 - Inserting a SIM

2.4 Connecting a Microphone/Speaker

The only way of connecting the microphone/speaker is via pins 3 - 6 of the 12-pin connector.

Please follow the specifications as listed in the table below. Skypatrol is not liable for damage to the EVOLUTION caused due to user error.

Ear – Speaker Output:

Parameter	Conditions	MIN	TYP	MAX	UNIT
Maximum Input Range – Mic(+) to Mic(-)	Inputs 3 dBm0 (Max. digital sample amplitude when PGA gain set to 0 dB)		32.5		mVrms
Nominal Ref. Level – Mic(+) to Mic(-)				-10	dBm0
Differential Input Resistance – Mic(+) to Mic(-)			100		kΩ
Microphone Pre-Amplifier Gain				25.6	dB
Bias Voltage on Mic(+)	2.0 or 2.5 V	2.0		2.5	Vdc
Mic Bias Current Capability		0		0.5	mA

Handset Speaker Output

Parameter	Conditions	MIN	TYP	MAX	UNIT
Maximum Swing – Ear(+) to Ear(-)	R_L = 32 Ω & 5% distortion	1.2	1.5		V_{pp}
Maximum Capacitive Load – Ear(+) to Ear(-)				100	pF
Amplifier Gain			1		dB
Amplifier State in Power Down	High Z				

Table 2 - Audio Settings

2.5 Connecting GSM/GPRS modem Antenna

The user must supply the GSM/GPRS antenna. The antenna must have a nominal impedance of 50 Ohms. The VSWR must be less than 2.0:1. System antenna gain should be 0 – 2 dB for optimum performance.

The antenna connector on the GSM/GPRS EVOLUTION model is a TNC female connector.

The antenna has to be connected to the connector labeled “MODEM ANT”. See Figure 11 - GSM/GPRS Antenna Connection.

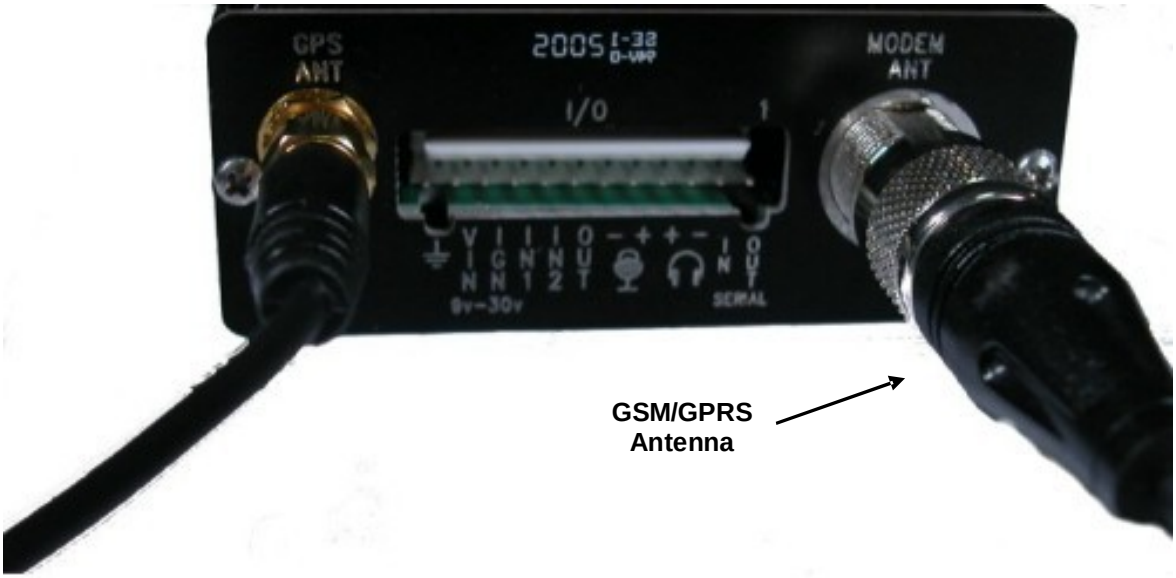

Figure 11 - GSM/GPRS Antenna Connection

2.6 Connecting GPS Antenna

The user must supply the GPS antenna. The GPS receiver inside the EVOLUTION powers the pre-amplifier in the GPS antenna (Active-style) by applying a power of 3.3 Volts to the center conductor of the RF input to the GPS receiver. If a passive-style GPS antenna must be used, please verify that it has a DC block installed in order to prevent shortening to ground. GPS antenna connector on the EVOLUTION model is a SMA female connector. The GPS antenna must be placed in an area where it can have direct view of the sky.

The GPS antenna must be connected to the connector labeled “GPS ANT”. See Figure 12 - GPS Antenna Connection.

User must disconnect power before connecting the GPS antenna

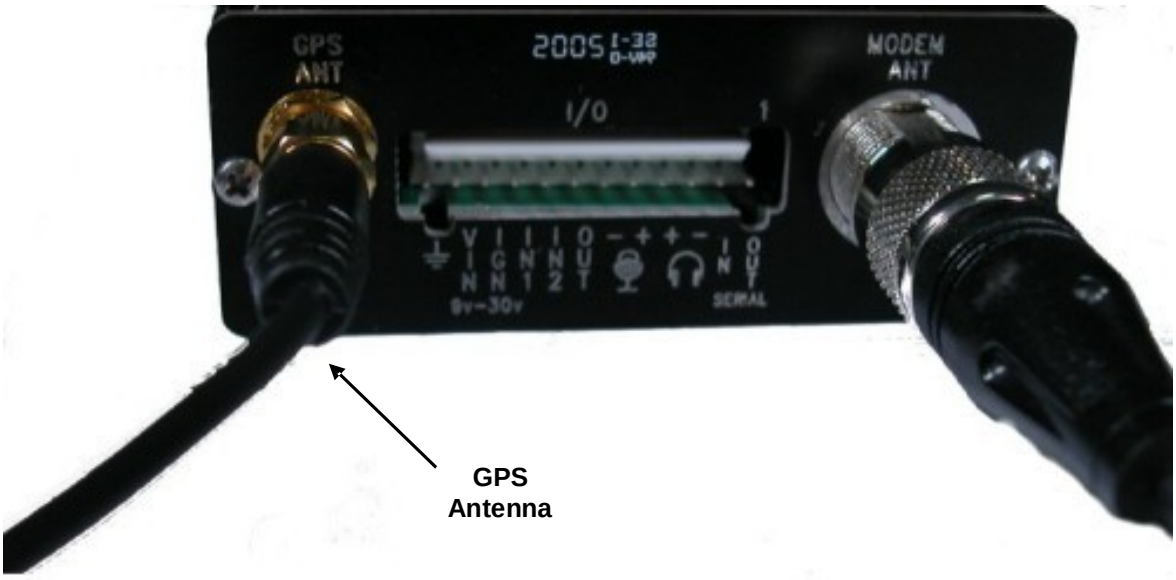

Figure 12 - GPS Antenna Connection

2.7 Connecting the Power Source

The GSM/GPRS EVOLUTION has an input voltage range of 5 – 30 V DC. (See Table 3 and Table 4). The power and ignition pins can support 5 – 30 V DC input voltage. The user has an option to connect these wires depending on the desired functionality. Described below are the desired functionality and their associated wire connecting procedure:

Please follow the specifications as listed in the table below. Skypatrol is not liable for damage to the EVOLUTION caused due to user error.

DRAFT TABLES

Skypatrol TT8540 (@ 12 Volts)			Average Current (mAmps)	Peak Current (Amps)
GSM 850 & 900	**GSM**	1TX/1RX 1RX Idle	390 mA 180 mA 65 mA	0.600 @ 32.5
DCS 1800 & PCS 1900	**GSM**	1TX/1RX 1RX Idle	400 mA 190 mA 55 mA	0.570 @ 32.0

Table 3 - GSM Operating Power

Skypatrol TT8540 (@ 12 Volts)			Average Current (mAmps)	Peak Current (Amps)
GSM 850 & 900	**GPRS**	1TX/1RX 1Rx Idle	400 mA 190 mA 55 mA	0.590 @ 32.0
DCS 1800 & PCS 1900	**GPRS**	1TX/1RX 1RX Idle	400 mA 200 mA 55 mA	0.560 @ 31.5

Table 4 - GPRS Operating Power

- EVOLUTION Always ON
  - Connect the power and ground wires of the EVOLUTION to the battery leads. The EVOLUTION will always remain ON as long as the battery lasts.
  - The EVOLUTION will be non-operational when the input voltage and current requirements are not met (battery drains).
  - The Ignition wire has to be left open (not connected).

- EVOLUTION Turns Off when Ignition Turned Off
  - Connect the power line of the EVOLUTION to an auxiliary power source, i.e. ignition.
  - Connect the ground wire to the chassis or negative terminal of the battery
  - The Ignition wire has to be left open (not connected).

- Device in Low Power Mode when Ignition Turned Off
  - Connect the power and ground wires of the EVOLUTION to the battery.

- Connect the ignition wire of the EVOLUTION to an auxiliary power source, i.e. ignition.
- Device enters low power mode when ignition line goes low. This feature has to be enabled via the software configuration (see AT$PWRSAV command for more details).
- Device enters normal power consumption mode when auxiliary power is supplied.
- Device goes through a reset upon ignition on.

2.8 LED Operation

The EVOLUTION has three LED's on its front panel.

PWR:	Indicates power to the modem. LED is on when power is turned on and the modem is operational. LED is off when power is removed or when the modem enters low power mode.
User LED 1:	This LED can be configured to display registration, GPS fix status, or other user functions. By default, this LED indicates GSM/GPRS registration status. LED state of OFF indicates that the device is not attempting to register to the network. Blinking LED indicates that the device is trying to connect to the network. LED always ON indicates that the device is attached to the network.
User LED 2:	This LED can be configured to display registration, GPS fix status, or other user functions. By default, this LED indicates GPS fix status. The LED remains in OFF state when invalid GPS data is received. The LED remains ON when valid GPS data is received.

3 Appendix 1 – Cable Wiring Diagrams

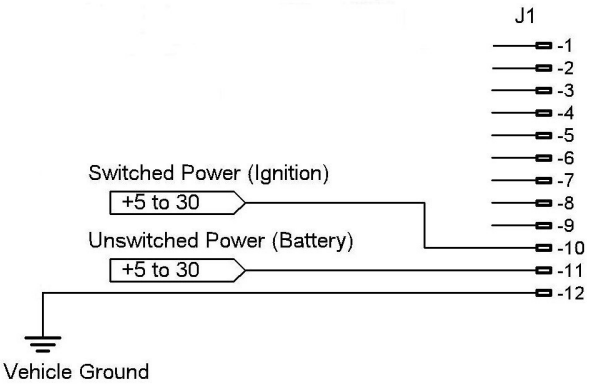

Figure 13 – Wiring for Power Only

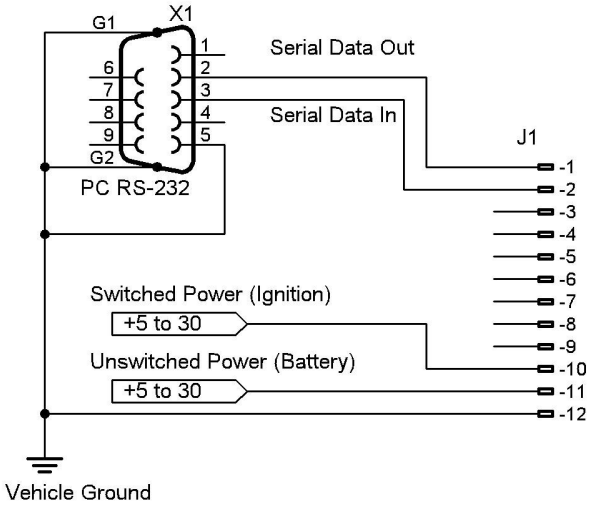

Figure 14 – Wire for Programming Cable

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